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COMPLEX PARTIAL EPILEPTIC-LIKE SIGNS AND DIFFERENTIAL VISUAL SEARCH TIMES FOR NORMAL MEN AND NORMAL WOMEN: IMPLICATIONS FOR FUNCTIONAL LATERALIZATION

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Summary—In order to evaluate the construct validity of a subjective experience inventory that has been employed to infer complex partial epileptic-like signs (CPELS), specific tasks such as the Seashore Rhythm, Speech-sounds, Immediate and Delayed Verbal and Figural Memory, Digit Span, Corsi block and Visual Search Tasks, were administered to 50 men and 50 women. The strongest correlation (0.57) occurred between the numbers of CPELS and search times for the upper relative to the lower right visual field for the men but not for the women. The results support the existence of sexual mosaicism and balanced human polymorphism within brain–behavioral correlates. Normative data for the neuropsychological tasks are also presented.

INTRODUCTION

We have been pursuing the concepts that: (1) electrical lability exists as a continuum within the temporal lobes of human populations (Makarec & Persinger, 1985, 1990; Persinger & Makarec, 1987, 1992, 1993) and (2) the validity of this construct can be inferred by the appropriate psychometric analyses of the reports of subjective experiences that are similar to those evoked by direct electrical stimulation of the deep structures (amygdala, hippocampus) within the temporal lobes (Gloor, 1972; Goldensohn, 1983; Horowitz & Adams, 1970; Stevens, Mark, Erwin, Pacheco & Suematsu, 1969). Electrical lability has been inferred by the (proportional) duration of α-rhythms and the standard deviations of the temporal variability of these electrical patterns over the temporal lobes in normal individuals. The strength of the association for these electroencephalographic inferences and the scores for clusters of experiences that reflect excitation within the temporal lobes is about + 0.50 for non-epileptic *S*s (Makarec & Persinger, 1990; Persinger & Richards, 1994).

A neural substrate for the quantitative relationship between the amount of electrical activity within the deep temporal lobes and the successive quantal shifts in classes of subjective experiences has been demonstrated by Babb, Wilson and Isokawa-Akesson (1987). They found that as the proportion of hippocampal and amygdaloid neurons that were recruited into paroxysmal discharges increased, symptoms shifted from subclinical states to rich phenomenological experiences (vestibular sensations, visual patterns or intensified 'ideational fragments'). Overt motor automatisms or frank convulsions and traditional epileptogenic signatures within electroencephalograms became evident only after a much larger proportion of subcortical neurons and a 'critical mass' of cortical columns (Goldensohn, 1983) had been recruited.

Whereas partial complex seizure patients would be distributed at the extreme end of the range of temporal lobe lability, creative individuals (artists, actors, musicians) would be distributed between epileptics and the normal population. This statement is compatible with: (1) the transient coherence between neuronal aggregates (that are typically not interactive) during periods of enhanced metabolic activity within mesiobasal temporal lobe structures, and (2) the strong association between hypomania (which is often associated with generalized increases in cerebral metabolic activity), creativity and symptomatic indicators of electrical activity within the temporal lobes (Makarec & Persinger, 1985; Persinger & Makarec, 1993). This approach is derived from a basic principle of neuroscience: at any

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given time those portions of the brain that are most metabolically active will determine the characteristics of the person's experience and behaviour.

Roberts, Varney, Hulbert, Paulsen, Springer, Shepherd, Swan, Legrand, Harvey, Struchen and Hines (1990) have shown that complex partial epileptic-like signs (CPELS) are very prominent among several subgroups of clinical patients who are refractory to treatment by traditional neuroleptic drugs. These individuals, who have often sustained a single mild to moderate brain injury, display severe impairment during dichotic word listening tasks. Treatment with carbamazepine attenuates the dichotic listening deficits and improves the symptoms. These changes suggest that the patients exhibit a 'neuroelectrical interference' within corpus callosal pathways between the temporal lobes (Springer, Garvey, Varney & Roberts, 1991).

The Personal Philosophy Inventory (PPI) contains 140 true–false items. About 60 of these items were selected because they refer to phenomenological or subjective experiences that are similar to those evoked by surgical stimulation of the deep temporal lobes or during ictal and postictal states. Three major clusters of items include: complex partial epileptic like signs (CPELS), interictal like behavior (ILB) and temporal lobe relevant behaviors (TLR); the organization of these clusters was derived from the similarity of the experiences to those reported by verified temporal lobe epileptics. The items "When sitting quietly, I have uplifting sensations as if I were driving quickly over a rolling road", "Intense smells bother me more than most people" and "I am very religious (more than most people)", are single examples of the CPELS, ILB and TLR clusters, respectively. Other examples of each these items, as well as those from the control cluster, are presented elsewhere (Hodge & Persinger, 1991; Persinger & Makarec, 1987, 1993).

Factor analysis of these 60 items of the PPI has produced four clusters of items that have been called: sensory-enhancement, affective, sense of a 'presence' or force and language-expressive factors. Sample items for each factor are: "I often feel if things are not real", "Sometimes I am so full of pep and energy that I feel superhuman", "At least once in my life very late at night I have felt the presence of another Being", and "After writing prose or poetry, I feel better", respectively. The clusters of items that were derived from the factor analyses were more clearly associated with traditional concepts of the functional charateristics of the left and right cerebral hemispheres.

Normal people who display enhanced numbers of temporal lobe signs also display higher scores on psychometric measures that infer the same behaviors that are qualitatively evident in clinical settings. Moderate strength positive correlations have been found between numbers of CPELS, in particular, and dissociation (Richards & Persinger, 1991), hypnotizability (Ross & Persinger, 1987) and variability in bipolar α-rhythm duration over the temporal but not the occipital lobes (Makarec & Persinger, 1990). We have suggested, as predicted by Bear's (1979) hypothesis of sensory-limbic hyperconnectionism and the revision of Penfield's hypothesis by Horowitz and Adams (1970), that enhanced electrical activity within the hippocampal-amygdaloid structures (temporal lobe lability) amplifies the intensity of the images and the affective perceptions that are evoked passively by listening to rich metaphors. The more frequent occurrence of slow wave (α-rhythm) activity over the temporal lobes in normal people who exhibit both elevated CPELS and suggestibility is a crude inference of the ratio of cortical driving from exogenous vs endogenous (bursts of temporal subcortical activation) stimulation.

The present study was designed to determine if traditional neuropsychological indices of temporal lobe functions are systematically correlated with subjective experiences that are similar to those evoked by electrical stimulation within this portion of the brain (Persinger & Makarec, 1987). Because of the significant differences in: (1) the functional (and probably microanatomical) organization of the limbic system (Remillard, Andermann, Testa, Gloor, Aube, Martin, Feindel, Guberman & Simpson, 1983), (2) the cognitive styles and (3) the phenomenological profiles (Persinger & Makarec, 1991) between men and women, we decided to analyze the sexes separately.

This approach was considered appropriate in light of the minor differences between sexes in the size (women larger) of the splenial portion the corpus callosum (de Lacoste-Utamsing & Holloway, 1982). Although average differences in the proficiency of tasks that primarily involve the portions of the hemisphere (occipitotemporal/occipitoparietal) that are interconnected by this callosal region could be evident, the concepts of sexual mosaicism (Witelson, 1991) or balanced human polymorphism (Annett, 1991) predict that the neurocognitive processes by which men and women accomplish comparable scores may be quite different. This relationship would be manifested by

differential correlations between key variables rather than mean differences between variables. Further support for the hypothesis that "men and women are similar but for different reasons" is reflected by: (1) the propensity for an eccentric thinking factor to contribute to enhanced temporal lobe signs in men but for an energetic factor to contribute to this prediction in women (Persinger, 1991) and (2) the observation that whereas the sensory enhancement factor contributes to beliefs and interpretations about religious and paranormal experiences for men, a factor that reflects a history of 'a sensed presence' is more important for women's beliefs and interpretations (Persinger & Richards, 1991) of both religious and paranormal experiences.

METHOD

Subjects

A total of 50 women and 50 men served as *S*s. All *S*s were university students; their ages ranged between 19 and 45 yr. The means and standard deviations for the men and the women were 26.5 (4.9) yr and 24.9 (4.4) yr respectively.

Procedure

Each *S* was tested individually. They were administered the following order of tests: the two narratives and the figures from the Wechsler Memory Scale (WMS), the first three columns (30 items) from the Speech–Sounds Perception Test, the Seashore Rhythm Test, recall (unexpected) of the two narratives and figures from the WMS, the digit span subtest from the Wechsler Adult Intelligent Scale (WAIS-R), Hebb's Recurring Digits Test (each individuals digit span + 1), the Corsi block (spatial span) procedure (Kolb & Whishaw, 1990) and then the Corsi block repeated pattern (spatial span + 1; sequences were the analog of Hebb's recurring digit procedure). Finally, Kimura's (1986) visual search task was given. Half the numbers of *S*s were administered the PPI before the neuropsychological sequence while the other half of the *S*s were given this self-report questionnaire after the sequence. All of the neuropsychological tasks were selected on the basis of their more specific association ('unique variance') with functions that are traditionally associated with either the left or the right temporal lobes (Kolb & Wishaw, 1990).

For each *S* the raw scores for the immediate and delayed verbal and figural memory tasks were calculated according to the manual's instructions. Numbers of correct responses for the Speech Sounds and Seashore Rhythm Task were determined. The Digit Span and Spatial Span (Corsi block) scores were defined as the first sequence that was failed on two successive attempts. The mean times (in seconds) for the 10 trials for each of the four visual fields (upper-left; upper-right; lower-left; lower-right) defined visual search latency.

In order to discern any potential weak 'hemispheric' effects that might be masked by individual differences, specific ratios were calculated for the above measures for each person. They were: (1) numbers of Speech Sounds items correct (of first 30)/numbers of Seashore Rhythm items correct (out of 30), (2) Digit Span/Spatial Span, (3) recurrent digit/recurrent spatial sequence, (4) Immediate Verbal/Immediate Figural Memory, (5) Delayed Verbal/Delayed Figural Memory, (6) Right Upper Visual Field Latency/Right Lower Visual Field Latency and (7) Left Upper Visual Field Latency/Left Lower Visual Field Latency.

The relevant clusters from the PPI were determined by computing the number of affirmative (or equivalent) responses for each cluster, dividing by the numbers of items per cluster and then multiplying by 100. Oneway analyses of variance were completed between men and women for each of the dependent variables. Pearson correlation coefficients were calculated between each of the temporal lobe relevant cluster scores and each of the above measures from the neuropsychological tests for men and women separately. On the bases of the results, canonical correlation coefficients (MANOVA) were determined between the relevant neuropsychological test scores and either the traditional or factor analyzed clusters of temporal lobe items. All analyses were completed by SPSSx software on a Vax 4000 computer.

Table 1 Means and standard deviations for neuropsychological tests, ratio measures and temporal lobe sign indicator scales for men and women

	Male		Female		
Variable	M	SD	M	SD	*F*-value
Speech Sounds	27.4	2.0	27.8	1.4	0.83
Seashore Rhythm	27.0	2.0	27.0	2.7	0.86
Digit Span	7.5	1.0	7.4	1.0	0.49
Space Span	7.0	0.9	7.0	0.9	0.66
Recurrent Digit	2.0	2.4	2.7	2.6	0.17
Recurrent Space	1.8	2.2	2.3	2.3	0.30
Immediate Verbal	20.9	6.0	22.2	5.9	0.30
Delay Verbal	19.2	6.0	19.9	5.7	0.31
Immediate Pic	11.3	2.1	11.4	1.7	0.84
Delay Pic	10.8	2.0	10.7	2.0	0.80
VS: MUPL	7.2	3.2	6.3	2.6	2.90
VS: MLOWL	8.5	3.5	7.0	2.7	5.28*
VS: MUPR	7.5	2.8	6.7	2.1	2.68
VS: MLOWR	7.6	3.5	7.5	3.2	0.12
SS/SR	1.0	0.1	1.0	0.1	0.51
Digit/Space	1.1	0.2	1.1	0.2	0.52
RDig/RSpace	1.6	1.7	1.9	2.1	0.58
ImVerb/Impic	0.6	0.2	0.6	0.2	0.13
Deverb/DelPc	0.6	0.2	0.6	0.2	0.22
VS:R/VS:L	1.0	0.4	1.2	0.5	2.44
VS:Lup/Llow	1.0	0.4	1.0	0.4	0.84
VS:Rup/Rlow	1.1	0.5	1.0	0.4	1.51
	Traditional				
Control	76	11	82	09	8.40*
CPELS	26	20	32	19	2.19
ILB	30	15	37	17	4.00*
TRL	35	10	42	12	7.65*
	Factor-derived Clusters				
Sensory	23	22	38	21	11.96**
Affective	49	21	57	19	3.90
Presence	14	18	16	19	0.36
Language	29	26	57	29	26.77**

VS, visual search times. *$P < 0.05$; **$P < 0.001$

RESULTS

The means and standard deviations of the scores for the neuropsychological tests and for the various clusters of temporal lobe indicators are shown in Table 1. Oneway analyses of variance (all d.f.s = 1, 98) demonstrated that women showed significantly faster visual search times relative to men when the stimulus was in the lower left field; there were no other statistically significant gender differences for the neuropsychological tests. Women displayed significantly ($P < 0.05$) more affirmative responses on the control, interictal-like behavior (ILB) and temporal lobe relevant (TLR) clusters compared to men. The more frequent endorsement of temporal lobe signs for women relative to men ($P < 0.001$) was most evident for the sensory enhancement and language (primarily diary keeping and poetry/prose writing) factors.

Men displayed consistent, statistically significant ($P < 0.01$) relationships between specific indicators of complex partial epileptic-like signs and search times for specific visual fields (Table 2). A moderately strong ($r = +0.57$) association was observed between the ratio of search times for the upper right field relative to the lower right field and CPELS (see Fig. 1). A comparable correlation was observed between this measure and the sensory-enhancement factor (Factor 1).

The strengths of the correlations were enhanced when the individuals' standardized values for each of the four visual fields were correlated with CPELS scores. Correlation coefficients are shown in Table 3. These standardized values were calculated to amplify intraindividual differences by subtracting the mean search time of each field from the mean of all four fields and then dividing by the standard deviation of all trials. Means for all four visual fields ranged between -0.1 to $+0.1$; the standard deviations ranged between 0.3 and 0.4. Removing the shared variance between the control ('yes responding') cluster and the visual search or any of the clusters of temporal lobe signs by partial correlation did not alter the strength of the statistically significant coefficients.

The women displayed no statistically significant correlations between any of the visual field

Table 2. Correlation coefficients between response latencies for each visual field during the visual search task and scores on the major temporal lobe signs clusters and factors for men

	Male					
Cluster	MUPL	MLOWL	MUPR	MLOWR	Lup/low	Rup/low
Control	0.01	0.11	0.11	0.27	−0.09	−0.17
CPELS	−0.07	−0.29*	0.33*	−0.34*	0.18	0.57**
ILB	−0.05	−0.24	0.29*	−0.19	0.19	0.37**
TRL	−0.12	−0.05	0.07	−0.18	−0.17	0.22
Sensory	0.05	−0.22	0.28*	−0.28*	0.22	0.48**
Affective	−0.16	−0.16	0.05	−0.20	−0.05	0.19
Presence	−0.09	−0.06	0.35*	−0.09	0.00	0.28
Language	0.12	0.07	0.22	0.15	0.09	0.05

*$P < 0.05$; **$P < 0.01$.

measures and any of the scales of indicators for temporal lobe signs. Numbers of correct responses for the Seashore Rhythm tests were weakly correlated with the 'sense of a presence' factor ($-0.31, P < 0.05$); this same factor was also negatively correlated (-0.32) with digit span for women. There were no other statistically significant correlations between the three clusters of temporal lobe signs and neuropsychological measures, even after partial correlation for yes (control cluster) responding.

In order to discern the maximum possible strength of the relationship between the set of visual field variables and the set of temporal lobe indicators, canonical correlations between the search times for the four visual fields and for the four theoretical or four factor-derived clusters of temporal lobe indicators were completed for the men. The results of these analyses are shown in Table 4. Each canonical correlation generated only one significant root. Men who displayed higher scores on the factors of sensory enhancement and the 'sense of a presence' also displayed longer search latencies in the upper right visual field but faster latencies in the lower right visual field. Only the CPELS and interictal-like (ILB) clusters were associated with this same pattern of visual field latencies.

To discern the maximum strength of the weak but statistically significant correlations between Digit Span and Seashore Rhythm performance and the clusters of temporal lobe signs that were observed for the women, canonical correlations were performed between the set containing these two variables as well as the Speech Sounds and Spatial Span scores and the set of either the four factor-derived clusters of temporal lobe signs or the four traditional clusters. Only one root for each analysis displayed rigorous significance (Table 5). Increase in the incidence of only CPELS was loaded on the same root

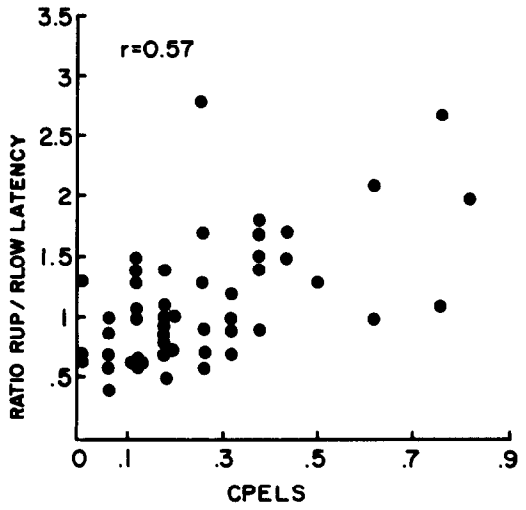

Fig. 1. Correlation between the ratio of visual search times between the upper right and lower right visual fields as a function of the relative numbers of complex partial epileptic-like signs (CPELS) for university men.

Table 3. Correlations between individually standardized visual search latencies and scores on temporal lobe indicator scales for men only

Measure	Upper Left	Lower Left	Upper Right	Lower Right
Control	−0.14	−0.05	−0.00	0.22
CPELS	0.05	−0.24	−0.53**	−0.39**
ILB	−0.01	−0.24	0.38**	−0.15
TRL	−0.08	0.07	0.21	−0.21
Sensory	0.16	−0.22	0.40**	−0.38**
Affective	−0.11	−0.03	0.23	−0.08
Presence	−0.12	−0.15	0.39**	−0.12
Language	−0.01	−0.05	0.04	0.02

**$P < 0.01$.

Table 4 Structure coefficients (correlations) for variables with the sets of visual search times and the two sets of temporal lobe variables for the first (and major) roots following canonical correlations ($N = 50$ men)

Variables	Coefficient	Variables	Coefficient
Upper left	−0.01	Upper left	0.07
Lower left	0.32	Lower left	0.56
Upper right	−0.72	Upper right	−0.53
Lower right	0.42	Lower right	0.63
Sensory-enhance	−0.85	Control	0.21
Affective	−0.29	CPELS	−0.88
Sense of presence	−0.65	ILB	−0.66
Language	−0.22	Temporal lobe relevant	−0.27
Canonical correlation	0.57		0.64

that was associated with greater Seashore Rhythm accuracy, less Speech Sounds accuracy and a larger spatial span.

On the other hand the same root that was associated with histories of greater incidence of experiences of ego-alien intrusion (but lower scores for the affective and language-expressive factors) was associated with greater accuracy on both the Seashore Rhythm and Speech Sounds tasks; performance on Spatial Span was not significantly loaded on this root. Additional canonical correlations between the two sets of variables containing the five ratio measures for immediate memory delayed memory, Digit/Spatial Span, recurrent digit/space, Speech Sounds/Seashore Rhythm (noted in Table 1) and either the factored or the traditional clusters of temporal lobe signs for men and women (separately) did not yield any consistent, strong roots.

Table 5. Structure coefficients (correlations) for a set of variables that suggested weak correlations with the set of either factored or traditional clusters of temporal lobe related experiences for women

Variables	Coefficient	Variables	Coefficient
Speech sounds	−0.45	Speech sounds	−0.58
Seashore rhythm	0.55	Seashore rhythm	−0.79
Digit span	0.21	Digit span	0.31
Space span	−0.48	Space span	0.22
Control	−0.24	Sensory enhance	0.14
CPELS	−0.49	Affective	−0.42
ILB	0.02	Sensed presence	0.64
TRL	0.29	Language	−0.47
Canonical correlation	0.44		0.57

DISCUSSION

Several researchers (Neppe, 1983; Persinger & Makarec, 1987, 1993; Roberts *et al.*, 1990) have shown that normal people report experiences that are similar but less intense than those displayed by: (a) patients who have electrical foci within the mesiobasal portions of the temporal lobes, or, (b) epileptic patients during surgical stimulation of these limbic regions. Our previous research (Persinger & Makarec, 1993) has demonstrated moderately strong associations between the numbers of subjective experiences that are similar to the elicited phenomenology in temporal lobe epileptic patients and: (a) the propensity to dissociate spontaneously (Richards & Persinger,1991), (b) increased hypnotic induction profiles (Ross & Persinger, 1987), (c) elevations on the hypomanic-schizoid scales of the MMPI (Persinger, 1991), (d) greater specific (ego-weakness) performance anxiety (Persinger & Makarec, 1987) and (e) a more active involvement with exotic beliefs and experiences (Persinger & Makarec, 1990), in normal (non-clinically epileptic) people. A conspicuous number of these people are also considered creative, intuitive and prone to bouts of energetic productivity.

Other studies have indicated some construct validity of these experiences as indicators of temporal lobe function. Roberts *et al.* (1990) and Springer *et al.* (1991) have shown consistent quantitative associations between the frequency of experiences that are similar to those associated with verified complex partial seizures (with stereotyped behaviors) and quantitative deficits in neuropsychological tasks that strongly suggest 'electrical interference' within the axons that compose or contribute to the corpus callosum. Makarec and Persinger (1985, 1990) found moderately strong positive correlation between the variability in the duration of alpha rhythm (a measure of 'lability') and the numbers of temporal lobe experiences while Sabourin and Persinger (1987) found that delayed cross-modal matching (touch-to-vision) performance was positively correlated with experiences that are most correlated with stimulation of the amygdala. In light of the deficits (Murray & Miskin, 1985) in delayed cross-modal matching reported for non-human primates in whom circumscribed lesions had been produced experimentally within this limbic structure, this enhanced capacity with elevated temporal lobe lability or sensitivity was expected.

The present study was designed to discern any major relationships between traditional neuropsychological measurements and the numbers of temporal lobe signs and symptoms. Although we realized the potential risk of the 'restricted population effect' by employing university students as *S*s, our major goal was to determine the presence of large effects. Clearly, the only 'large' effect that was found in this study involved visual search times and the numbers of complex partial epileptic-like signs (CPELS) for men only.

The positive association between numbers of CPELS and time required to detect objects in the right visual field in general and in the upper right visual field (relative to the lower right field), in particular, supports the hypothesis that these experiences reflect temporal lobe function. Upper peripheral visual field deficits or anomalies (e.g. flashing lights) are well known correlates of temporal lobe lesions or electrical foci (Dreifuss & Lee, 1981; Remillard *et al.*, 1983). The absence of any systematic significant correlation between CPELS and search times in the left visual field or between search times in the right visual fields and other clusters of items (especially the control clusters) indicates the specificity of the effect.

The traditional interpretation of an anomaly of the upper right (peripheral) visual field is an alteration in left temporooccipital lobe function due to involvement of Meyer's loop. If this assumption was applicable in this population of normal men, then elevated numbers of CPELS would imply delayed visuospatial processing within the left temporooccipital lobe relative to women. If we (Persinger & Makarec, 1993; Roberts *et al.*, 1990) are correct that the numbers of complex partial epileptic-like experiences reflect elevated neuroelectrical activity, then greater interference within interhemispheric object-to-label coding would be expected. This interference should affect the search (and implicitly linguistic recognition and labelling) in the male brain because of the significant role of this region in linguistic processing. Compatible sex differences in the functional organization of language within the hemispheres have been shown by Kimura (1987).

Support for this supposition is suggested by the positive association between scores on the sensory-enhancement factor and other 'left hemispheric' phenomenology for men only (Persinger & Makarec, 1993; Persinger & Richards, 1991). In addition, whereas CPELS were most strongly correlated with the schizoid subscale of the Minnesota Multiphasic Personality Inventory (MMPI) for

university men, CPELS are most strongly correlated with the hypomania subscale for university women (Persinger, 1991). The propensity for thought anomalies is more typical of disruptions within the left hemisphere while affective anomalies is most often associated with distruptions within the right hemisphere (Andreasen, 1988; Roberts & Bruton, 1990).

The occurrence of a mid-magnitude correlation between complex partial epileptic-like signs and a specific, salient neuropsychological indicator for men but not women would be compatible with both Witelson's (1991) concept of sexual mosaicism and Annett's (1991) idea of normal human polymorphism. Both approaches argue that, adjusting for intelligence and physical artifacts, the *average* proficiency and efficiency for men and women for most tasks do not differ. However the neurocognitive processes by which they complete these operations may differ significantly. Consequently, the *intercorrelation* matrices between phenomenological variables (inferred by cognitive style or the pattern of subjective experiences) and performance-based tasks should exhibit a conspicuous 'mosaic or polymorphic' pattern.

The strength of the correlation between CPELS and the delay to detect visual stimuli in the upper right visual field is sufficient to consider practical applications. If this result has ecological relevance, then men who display higher scores on CPELS inventories might also be prone to ignore stimuli within the upper right (peripheral) visual field. Since this field occupies a significant portion of the windshield along the passenger's side of North American automobiles, one would expect that more accidents involving male drivers would be associated with vehicles approaching from the right (especially if the plane is elevated into the upper field, e.g. an access ramp).

The weak associations between the auditory (e.g. dichotic listening) tasks and a specific cluster of items that are inferred to reflect temporal lobe signs for the women but not for the men are compatible with other studies (Persinger & Richards, 1991; Skirda & Persinger, 1993). A history of a sensed presence which we (Persinger & Makarec, 1992) have argued is the transient intrusion of the right hemispheric homologue of the left hemispheric (and highly linguistic) sense of self into awareness, was more likely for women who had lower bitemporal lobe efficiency as inferred by less accurate scores for the Seashore Rhythm and Speech Sounds Perception Tests. The data from Munro and Persinger (1992), which compliments the general pattern for verifiable foci of complex seizures in patients (Phelps & Mazziotta, 1985), suggests that lower scores (but within the normal range) often reflect *hypometabolic* activity within a region. During periods of compensatory hypermetabolic activity the functions associated with this region dominate subjective experience. If the vectorial hemisphericity model (Persinger, 1993) is valid, then these brief periods would encourage temporal (parietal) lobe intercalation (Corsi-Cabera, Herrera & Malvido, 1989) and the experience of a sensed presence.

Whether or not comparable or stronger associations between neuropsychological scores and CPELS would emerge in clinical populations must still be tested. All of the scores for temporal lobes signs and for the neuropsychological tests for the men and women in this study were within the normal range. On the other hand we (Persinger & Makarec, 1993) have shown that groups of patients who display, (1) long periods of subclinical seizures before complex partial epilepsy is diagnosed, (2) posttraumatic stress disorders or (3) the phobic-anxiety depersonalization (panic) syndrome, generate *T* scores above 70 on specific clusters of temporal lobe signs and indicators. They would also be expected to display stronger, specific deficits on those neuropsychological tasks whose unique variance is most associated with temporal lobe function.

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